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## 1. Your reference

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## 2. Patent application number

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0310692.9

09 MAY 2003

## 3. Full name, address and postcode of the or of each applicant (underline all surnames)

Mobiqa Limited  
111 George Street  
EDINBURGH  
EH2 4JN

Patents ADP number (if you know it)

8465726001

If the applicant is a corporate body, give the country/state of its incorporation

UK

## 4. Title of the invention

Optimised mobile barcode message

## 5. Name of your agent (if you have one)

Kennedy's Patent Agency Limited

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

Floor 5, Queens House  
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Patents ADP number (if you know it)

08058240002 ✓

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11.  We request the grant of a patent on the basis of this application.

Signature

Kennedy

Date

9 May 2003

12. Name and daytime telephone number of person to contact in the United Kingdom

KENNEDYS

Jim Adams

0141 226 6826

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1 Optimised Mobile Barcode Messages

2

3 The present invention relates to coupons, in particular  
4 delivering coupons containing barcodes to a mobile  
5 device.

6

7 The display of a mobile device may be used to generate  
8 bar codes for reading by a conventional bar code scanner.  
9 This has uses in coupon and ticket applications. The  
10 mobile solution has a number of unique aspects when  
11 compared to traditional methods such as paper or internet  
12 email. These include:

13 - Instant Delivery. The barcode is delivered to the  
14 mobile phone almost immediately.  
15 - Reach. The consumer can be reached wherever they are.  
16 - Increased Redemption. Unlike paper coupons which may be  
17 left behind, a mobile phone is normally carried  
18 everywhere.

19

20 GB Patent Application Number GB2361570 to British Airways  
21 discloses a method of operating a ticketing System. A  
22 reservation centre generates data representing a ticket  
23 which is broadcast to a mobile station e.g. a cellular

1 phone. The data from the mobile station can then be used  
2 to verify the transaction e.g. via a reader linked to a  
3 reservations computer. The ticket data can be sent in the  
4 form of a text e.g. SMS message or in browser readable  
5 format and is preferably in machine readable code.  
6 Preferably, the reader is an optical bar or pin code  
7 reader. The system is preferably used for air travel. The  
8 problems with the disclosed system are that:  
9 - There doesn't appear to be a way of enforcing single  
10 redemption of a ticket (for security).  
11 - It relies on a "SIM toolkit" application in the handset  
12 to translate the ticket number into a barcode image. It  
13 would be advantageous to deliver the actual barcode image  
14 in the message. The SIM toolkit has a number of problems.  
15 Many network operators discourage or prevent downloading  
16 of applications into the SIM card. SIM storage is limited  
17 and it's harder to update the software on all of the  
18 phones.

19  
20 International Patent Application number WO 01/95267 to  
21 Nokia relates to the provision of goods and services.  
22 Receipt data corresponding to a purchase of predetermined  
23 goods or a service are downloaded to a mobile handset and  
24 displayed as a bar code. A vending delivery station  
25 receives the receipt data from the handset and enables  
26 the provision of the purchase goods or service to the  
27 customer. In one example, cinema tickets are provided,  
28 printed by a ticket printer. The problem with the system  
29 is that it requires the consumer to collect tickets which  
30 are printed by a vending station before entry. It would  
31 be advantageous to simply treat the phone / barcode as a  
32 ticket which is scanned at the actual entry point, thus  
33 eliminating the queueing / inconvenience and printing.

1 The publication discloses MPEG film previews when  
2 browsing the cinema options. This is not however included  
3 as part of the ticket. It would be advantageous to  
4 provide multimedia tickets to phones that can support  
5 their viewing.

6

7 GB Patent Application Number GB2362012 to IBM discloses  
8 Paying for goods and services without needing to carry  
9 many cards. A customer, who has registered information  
10 such a credit card number with a server, receives payment  
11 information as an identification code when he/she pays  
12 for a purchase at a store. The payment information can be  
13 transmitted wirelessly to the cash register in store, or  
14 displayed as a two-dimensional barcode on display of the  
15 terminal and read by a barcode reader of the cash  
16 register. The payment information is associated with  
17 sales information and sent to the server which associates  
18 the payment information with the registered information  
19 for the customer, seeks approval from the appropriate  
20 credit institution, and sends an approval number to the  
21 store. A ticket processing system embodiments is also  
22 described.

23

24 The problem with both the Nokia and IBM systems is that  
25 they don't facilitate operation with a variety of phones  
26 with different messaging formats and display or  
27 communication capabilities. For example, it would be  
28 advantageous for one system to support mobile phones that  
29 do or do not support "Picture Messaging" or Bluetooth.  
30

31 In this document, including the specification and claims,  
32 the term coupon includes vouchers and tickets.  
33

1 It is an object of the present invention to deliver  
2 coupons to a mobile device.

3

4 According to a first aspect of the present invention,  
5 there is provided a system comprising

- 6     ■ a message processor means for generating message
- 7         data comprising a coupon;
- 8     ■ a mobile device;
- 9     ■ a message optimiser means for generating an
- 10         optimised message responsive to said message data
- 11         and the capabilities of said mobile device; and
- 12     ■ A communication means for transmitting said
- 13         optimised message to said mobile device.

14

15 Preferably the system further comprises a database means  
16 for storing capabilities of mobile devices.

17

18 Preferably said capabilities comprise at least one device  
19 attribute associated with a mobile device type.

20

21 Typically said attribute comprises a display dimension.

22

23 Typically said attribute comprises a colour depth.

24

25 Preferably said communication means comprises a gateway  
26 means for transmitting said optimised message to a  
27 network.

28

29 Preferably said communication means further comprises a  
30 router means for selecting a gateway means for message  
31 transmission.

32

33 Preferably said coupon comprises a barcode number.

1  
2     Optionally said coupon comprises barcode symbology.  
3  
4     Optionally said coupon comprises a barcode image.  
5  
6     Optionally said coupon comprises text content.  
7  
8     Optionally said optimised message further comprises  
9     multimedia content.  
10  
11   Typically said multimedia content comprises video.  
12  
13   Optionally said multimedia content comprises audio.  
14  
15   Optionally said multimedia content comprises a  
16     photograph.  
17  
18   Optionally said system comprises a mobile device type  
19     identifier.  
20  
21   Typically said coupon comprises said mobile device type  
22     identifier.  
23  
24   Preferably said message optimiser is responsive to said  
25     capabilities corresponding to said mobile device type  
26     identifier.  
27  
28   Preferably said system further comprises a barcode  
29     encoder means for encoding barcodes.  
30  
31   Preferably said system further comprises a barcode  
32     generator means for generating barcodes.  
33

1 Optionally said generated barcodes are random barcodes.

2

3 According to a second aspect of the present invention,  
4 there is provided a method for delivering a message to a  
5 mobile device comprising the steps:

6     ▪ generating message data comprising a coupon;  
7     ▪ generating an optimised message responsive to said  
8         message data and the capabilities of said mobile  
9         device; and  
10    ▪ transmitting said optimised message to said mobile  
11         device.

12

13 Preferably said method further comprises the step of  
14 inputting capabilities of mobile devices.

15

16 Preferably said method further comprises the step of  
17 storing capabilities of mobile devices.

18

19 Preferably said capabilities comprise at least one device  
20 attribute associated with a mobile device type.

21

22 Typically said attribute comprises a display dimension.

23

24 Typically said attribute comprises a colour depth.

25

26 Preferably said method further comprises the step of  
27 transmitting said optimised message to a network.

28

29 Preferably said method further comprises the step of  
30 selecting a gateway means for message transmission.

31

32 Preferably said coupon comprises a barcode number.

33

- 1 Optionally said coupon comprises barcode symbology.
- 2
- 3 Optionally said coupon comprises a barcode image.
- 4
- 5 Optionally said optimised message further comprises
- 6 multimedia content.
- 7
- 8 Typically said multimedia content comprises video.
- 9
- 10 Optionally said multimedia content comprises audio.
- 11
- 12 Optionally said multimedia content comprises a
- 13 photograph.
- 14
- 15 Optionally said coupon comprises a mobile device type
- 16 identifier.
- 17
- 18 Preferably said method further comprises the step of
- 19 retrieving capabilities corresponding to a mobile device
- 20 type identifier.
- 21
- 22 Preferably said step of generating an optimised message
- 23 is responsive to said retrieved capabilities.
- 24
- 25 Preferably said step of generating an optimised message
- 26 comprises downgrading said generated message data.
- 27
- 28 Preferably said method further comprises the step of
- 29 encoding barcodes.
- 30
- 31 Preferably said method further comprises the step of
- 32 generating barcodes.
- 33

1 Preferably said generated barcodes are random barcodes.

2

3 According to a third aspect of the present invention,  
4 there is provided a message comprising a coupon and  
5 multimedia content.

6

7 Typically said multimedia content comprises video.

8

9 Optionally said multimedia content comprises audio.

10

11 Optionally said multimedia content comprises a  
12 photograph.

13

14 Preferably said coupon comprises a barcode number.

15

16 Optionally said coupon comprises barcode symbology.

17

18 Optionally said coupon comprises a barcode image.

19

20 In order to provide a better understanding of the present  
21 invention, an embodiment will now be described by way of  
22 example only and with reference to the accompanying  
23 Figures, in which:

24

25 Figure 1 illustrates, in schematic form, the core  
26 technology platform in accordance with the present  
27 invention;

28

29 Figure 2 illustrates, in schematic form, the core mobile  
30 barcode generation, delivery and redemption process in  
31 accordance with the present invention;

32

1 Figure 3 illustrates, in schematic form, the redemption  
2 architecture and process in accordance with the present  
3 invention;

4

5 Figure 4 illustrates, in schematic form, the mobile  
6 barcode generation, delivery and redemption process  
7 customised for the retail coupon market;

8

9 Figure 5 illustrates, in schematic form, the mobile  
10 barcode generation, delivery and redemption process  
11 customised for ticketing applications;

12

13 Figure 6 illustrates, in schematic form, the mobile  
14 barcode generation, delivery and redemption process  
15 customised for security applications;

16

17 The invention is a platform that functions to deliver  
18 coupons to a mobile device. Typically the coupons contain  
19 barcodes that are redeemed by scanning the display of the  
20 mobile device.

21

22 With reference to Figure 1, the application 102  
23 interfaces to the core technology platform 104 for  
24 advanced mobile messaging using XML content delivered  
25 over the internet http protocol.

26

27 The Message Processor 106 is started automatically in  
28 response to the delivery of message content to a  
29 specified URL.

30

31 The message processor receives the mobile phone number,  
32 barcode number and symbology, handset/device type and  
33 additional message content for delivery to the device.

10

1 The handset/device type is optional. When it is provided,  
2 it is stored in the database against the mobile number.  
3 In the case of future messages for that mobile number  
4 where the device type is not provided, then the recorded  
5 device type is retrieved. This avoids the need to capture  
6 the handset/device type on multiple occasions or for  
7 different purposes such as coupon or ticket delivery.

8

9 The message content is provided in XML format, and  
10 delivered using the http post protocol. The XML is a list  
11 of messages containing information including:

12 - Mobile phone number  
13 - Barcode number and symbology  
14 - Additional text content (optional)  
15 - Recipient details such as Name (optional)  
16 - Handset and Network details (optional)

17

18 The Message Processor processes the messages and stores  
19 them in the database for retrieval by the Queue  
20 Controller 114.

21

22 The Barcode Encoder 108 is invoked to generate barcode  
23 images from the barcode number and symbology. The images  
24 are stored as Pictures in the database.

25

26 Customer systems can be integrated with the mobile  
27 messaging platform through the message processor.

28

29 The database 110 stores the following core entities:  
30 - Barcodes - Barcodes with a particular number and  
31 symbology  
32 - Pictures - Pictures (may represent a barcode image)

11

- 1 - Handset - information on a particular handset including
- 2 owner details, mobile number, model, etc.
- 3 - Messages - Outbound and inbound messages
- 4 - Gateways - Network messaging gateways

5

6 The barcode encoder generates the barcode image for a  
7 specified barcode and symbology. The resulting picture is  
8 stored in the database in binary form. The encoder  
9 supports both linear barcodes such as EAN-8, EAN-13, UPC-  
10 A, etc. as well as 2D barcodes such as DataMatrix, PDF-  
11 417, etc. ..

12

13 A similar approach can be used for other advanced message  
14 types such as smart tickets.

15

16 The Message Engine 112 starts a separate queue controller  
17 for each message priority level (1-3). The Message engine  
18 also starts the gateways.

19

20 The Queue Controllers 114 poll the database at periodic  
21 intervals to retrieve all messages with the relevant  
22 priority. The messages are then fed through the Message  
23 Optimiser and Message Routers and out through the  
24 selected gateway.

25

26 The Message Optimiser 116 chooses the optimal message  
27 format depending on the capabilities of the target  
28 handset. For basic handsets, a simple text message will  
29 be delivered. Otherwise, subject to the handset  
30 supporting the required display dimensions and colour  
31 depth, pictures are delivered using the richest format  
32 available.

33

1 The Message Optimiser overcomes many of the problems  
2 inherent with known methods. In particular, the wide  
3 range of device types/models and message protocols  
4 restrict many alternative solutions to providing support  
5 for only a limited number of users. Devices can vary in  
6 their support for particular picture messaging protocols  
7 such as Nokia Smart Messaging or EMS (Enhanced Message  
8 Service). Device display capabilities such as display  
9 resolution also constrain the barcode symbologies and  
10 codes that may be represented. The present invention  
11 enables a comprehensive support of the installed base of  
12 devices to be provided.

13

14 The Message Optimiser takes the barcode image generated  
15 by the Barcode Encoder, and device type and optimises the  
16 messages for transmission based on the capabilities of  
17 the target handset.

18

19 Where the target device does not have sufficient  
20 capability to receive or represent the message correctly,  
21 the content is downgraded accordingly. Ultimately, for a  
22 handset that supports only SMS text messaging, then the  
23 barcode number and associated text is transmitted. E.g.  
24 "Barcode <12345670>. Ticket for Event at Venue on Date".  
25 In the case of a text-only barcode, the barcode is  
26 redeemed by keying-in the number. This is also the  
27 common, automatic approach when a barcode image fails to  
28 scan.

29

30 The downgrading of the content is controlled by a  
31 hierarchy of rules based on the device capability. This  
32 includes:

33 1. MMS support

1 2. EMS support  
2 3. Nokia Smart Message support  
3 4. Display Resolution  
4  
5 If the display resolution is insufficient to represent  
6 the barcode, then the message is downgraded to text.  
7  
8 A table of device attributes associated with a device  
9 type is maintained in the database. This table includes  
10 the following information:  
11 1. Handset/Device Type  
12 2. MMS Support  
13 3. EMS Support  
14 4. Nokia Smart Message Support  
15 5. Display Resolution  
16 6. Colour Depth (1 = mono)  
17 7. Bluetooth support  
18 8. Java support  
19  
20 Where the handset model is not known, then the  
21 capabilities of the database device entry with id of  
22 "DEFAULT" are assumed. This enables such behaviour to be  
23 controlled. i.e. whether to assume that an unknown  
24 handset supports Nokia picture messages or not.  
25  
26 The barcode image can also be a 2D barcode. A 2D barcode  
27 enables a larger amount of information to be contained  
28 within the barcode.  
29  
30 If the device has a multimedia capability, then messages  
31 can also be enhanced by the addition of moving video,  
32 colour images, and audio clips. Mobile phones may support  
33 MMS (Multimedia Messaging Service). In this case a ticket

1 for a music concert could include a short piece of video  
2 of the band, an image of the cover of the new album, and  
3 an audio clip for a recently released track in addition  
4 to the barcode. Similarly, in order to promote a brand, a  
5 coupon could contain a video clip and audio from a TV  
6 advertisement in addition to the barcode. In security  
7 applications, a photograph could be included with the  
8 barcode.

9

10 The message router 118 chooses the optimal network  
11 gateway based on rules stored in the database. Multiple  
12 gateway connections can be supported for load balancing  
13 and scalability. Where there is more than one possible  
14 route, the gateway with the lowest latency is chosen.

15

16 The gateways 120 are the route to the external SMS  
17 gateways or SMS centres over a network. The gateways  
18 maintain a queue of messages sorted by priority. A number  
19 of different SMS gateway technologies are supported  
20 including XML/http, SMPP, GSM terminals, etc.

21 Alternatively the gateway can be an email gateway,  
22 delivering the messages as an email message. Pictures may  
23 be attached as a GIF image.

24

25

26 The SMS gateway 122 is a gateway to the mobile network  
27 short messaging service. Alternatively, this may be a  
28 direct connection to the mobile network operator's  
29 messaging centre. The SMS gateway may support enhanced  
30 messages (EMS) such as picture messages. The SMS gateway  
31 may be a multi-media message (MMS) gateway for delivery  
32 of multimedia messages including high-resolution colour  
33 images and video.

1

2 The mobile handset 124 can be a mobile phone or other  
3 wireless-enabled device such as a PDA.

4

5 The core technology platform supports processes in a  
6 number of applications. Additional components are defined  
7 to support the specific steps in such solutions. Thus the  
8 system also may also include an Automatic Download  
9 component 126 and a Random Barcode Generator component  
10 128 for customisation of the system as described below  
11 for retail coupon and security applications respectively.

12

13 With reference to Figure 2 the core mobile barcode  
14 generation, delivery, and redemption process 200 is  
15 depicted.

16

17 The consumer opts-in to receive barcodes by registering  
18 202 with the supplier. Registration may be through a  
19 variety of channels including internet web site,  
20 telephone call centre, paper forms, or text message.

21

22 The registration details are stored in the database 204.  
23 The database contains customer contact and profiling  
24 information. This information includes:

25 - Customer details and contact information including  
26 mobile number and possibly name, email address, postal  
27 address, photograph, etc.  
28 - Customer demographics including age, sex, etc.  
29 - Customer preferences  
30 - Customer buying history

31

32 In the Target Profile step 206, an offer for a product,  
33 service, or information is matched with the database of

1 customer profiles. The matching criteria may include one  
2 or more of:

- 3 - Demographics
- 4 - Preferences/Product Criteria
- 5 - Buying History

6

7 The result of the match is a list of mobile numbers for  
8 contact purposes and profile information for message  
9 personalisation.

10

11 The specified barcodes are generated from the number(s)  
12 provided and delivered 208 to the list of mobile numbers  
13 using the messaging platform. This step is expanded  
14 towards the right hand side of Figure 2.

15

16 After inputting and storing 210 device attributes  
17 defining the device capabilities in the database and  
18 inputting 212 a device type identifier (e.g. model of  
19 mobile 'phone), the system generates 214 message data  
20 comprising a coupon and optionally the device type  
21 identifier.

22

23 The system retrieves 216 device attributes defining the  
24 device capabilities corresponding to the mobile device  
25 type identifier and generates 218 an optimised message  
26 responsive to the message data and the retrieved  
27 capabilities.

28

29 Finally in the delivery step, the system transmits 220  
30 the optimised message to the target mobile device via one  
31 or more gateways through a network.

32

1 The delivery of a barcode is recorded in the database for  
2 subsequent authentication purposes.

3

4 The barcode is redeemed 222 in the same way as any  
5 product containing a barcode, by scanning the mobile  
6 phone display using a conventional barcode scanner. An  
7 alternative to scanning the barcode for redemption could  
8 be to use Bluetooth or an alternative radio or electro-  
9 magnetic transmission method.

10

11 The barcode is authenticated 224 by examining the barcode  
12 delivery records and retrieving the associated customer  
13 details. The customer details, possibly including a  
14 photograph, may be displayed on a computer display for  
15 human validation.

16

17 Barcode redemption is recorded in the database for audit  
18 purposes.

19

20 If this barcode is to be redeemed only once, then the  
21 barcode record in the database is marked as redeemed, and  
22 cannot be redeemed again.

23

24 With reference to Figure 3, the redemption process 300 is  
25 shown. In the case of a coupon, the barcode is sent to  
26 the mobile device 302 and is scanned at the outlet or  
27 venue 304, and the number is used to identify the offer  
28 by searching the database in the core technology platform  
29 104 according to the present invention. In the case of a  
30 single-redemption barcode such as a ticket, the barcode  
31 is validated against the database 306. The barcode entry  
32 in the database is then marked as 'redeemed' to prevent  
33 multiple redemption of the same barcode.

1

2 Specific solutions based on the core technology platform  
3 are defined and will be presented below for a number of  
4 markets:

- 5 - Retail Coupons
- 6 - Ticketing
- 7 - Security

8

9 With reference to Figure 4, the mobile barcode solution  
10 process 400 is customised for the retail coupon market.  
11 The mobile barcode represents a discount coupon which is  
12 redeemed by scanning in a retail outlet.

13

14 Barcodes representing discount coupons may be redeemed  
15 multiple times without any authentication. Indeed, viral  
16 marketing may be encouraged through forwarding of the  
17 mobile barcode to friends and family.

18

19 In Figures 4, 5 and 6, each of the steps having numbering  
20 common with Figure 1 are described above.

21

22 The Coupon Download 402 ("pull") is initiated by a  
23 consumer via a number of channels including:

- 24 - Web site
- 25 - Telephone
- 26 - Mobile text Message sent to a supplier mobile number

27

28 In each case, the recipient's mobile number is captured  
29 in order that the mobile barcode coupon may be delivered  
30 404.

31

32 The solution builds on the core process with an Automatic  
33 Download component 126 shown in Figure 1. The automatic

1 download component is invoked from a web site, automated  
2 telephone system, or through receipt of a text message.  
3 The component takes the mobile number and barcode number  
4 and invokes the Message Processor using XML/http to  
5 deliver the mobile barcode.

6

7 With reference to Figure 5, the mobile barcode solution  
8 process 500 is customised for ticketing applications. The  
9 mobile barcode represents a ticket that is redeemed by  
10 scanning the phone display at the venue.

11

12 Specific steps in the mobile ticketing solution are:

- 13 - Deliver Promotional Message 502
- 14 - Purchase 504

15

16 With reference to Figure 5, the first steps (down to but  
17 not including Purchase 504) are optional.

18

19 An example promotional message might be:

20 Ticket available for Sat. Call 0800 123456 or reply "1"  
21 to buy.

22

23 The promotional message may be delivered as a simple text  
24 message, or might be a richer message including text and  
25 pictures.

26

27 The purchase may be achieved through a number of channels  
28 including:

- 29 - Ticket sales call centre
- 30 - Web site
- 31 - Text message reply

32

1 Payment may be received through one of many existing  
2 methods including credit card and existing account. When  
3 payment is accepted, then the mobile barcode ticket is  
4 delivered 506.

5

6 As the Message Processor supports simple text messages as  
7 well as more sophisticated data (barcodes), the  
8 promotional message is delivered using the core platform.

9

10 The ticket purchase is achieved using traditional  
11 methods.

12 With reference to Figure 6, the mobile barcode solution  
13 process 600 is customised for security applications. The  
14 mobile barcode represents an identity that is validated  
15 by scanning the phone display. Upon validation, access  
16 can be granted to a secure location, or a product can be  
17 provided.

18

19 There is an automatic random barcode generation step 602.  
20 A new random barcode may optionally be generated and  
21 delivered every time a barcode is redeemed.

22

23 The solution builds on the core process with the Random  
24 barcode generator component 128 shown in Figure 1. The  
25 Random barcode generator automatically generates a random  
26 barcode number. The barcode number generated is unique  
27 amongst unredeemed barcodes in the database.

28

29 Key features of the solutions described herein are:

- 30 - Targetting using a customer profile database
- 31 - Dynamic barcode image generation from barcode number
- 32 and symbology

- 1 - Delivery of barcode to mobile phone or other wireless device
- 2 - Redemption and authentication of barcode by scanning display
- 3 - Specific processes for particular applications

6  
7 The solutions described above are implemented using Java  
8 2 Enterprise Edition, SQL, and XML (extensible markup  
9 language). Alternative technologies could however be used  
10 to implement the solutions described above.

11  
12 Although the embodiments of the invention described with  
13 reference to the drawings comprise computer apparatus and  
14 processes performed in computer apparatus, the invention  
15 also extends to computer programs, particularly computer  
16 programs on or in a carrier, adapted for putting the  
17 invention into practice. The program may be in the form  
18 of source code, object code, a code of intermediate  
19 source and object code such as in partially compiled form  
20 suitable for use in the implementation of the processes  
21 according to the invention. The carrier may be any  
22 entity or device capable of carrying the program.

23  
24 For example, the carrier may comprise a storage medium,  
25 such as ROM, for example a CD ROM or a semiconductor ROM,  
26 or a magnetic recording medium, for example, floppy disc  
27 or hard disc. Further, the carrier may be a  
28 transmissible carrier such as an electrical or optical  
29 signal which may be conveyed via electrical or optical  
30 cable or by radio or other means.

31  
32 When the program is embodied in a signal which may be  
33 conveyed directly by a cable or other device or means,

1 the carrier may be constituted by such cable or other  
2 device or means.

3

4 Alternatively, the carrier may be an integrated circuit  
5 in which the program is embedded, the integrated circuit  
6 being adapted for performing, or for use in the  
7 performance of, the relevant processes.

8

9 Further modifications and improvements may be added  
10 without departing from the scope of the invention herein  
11 described.

12

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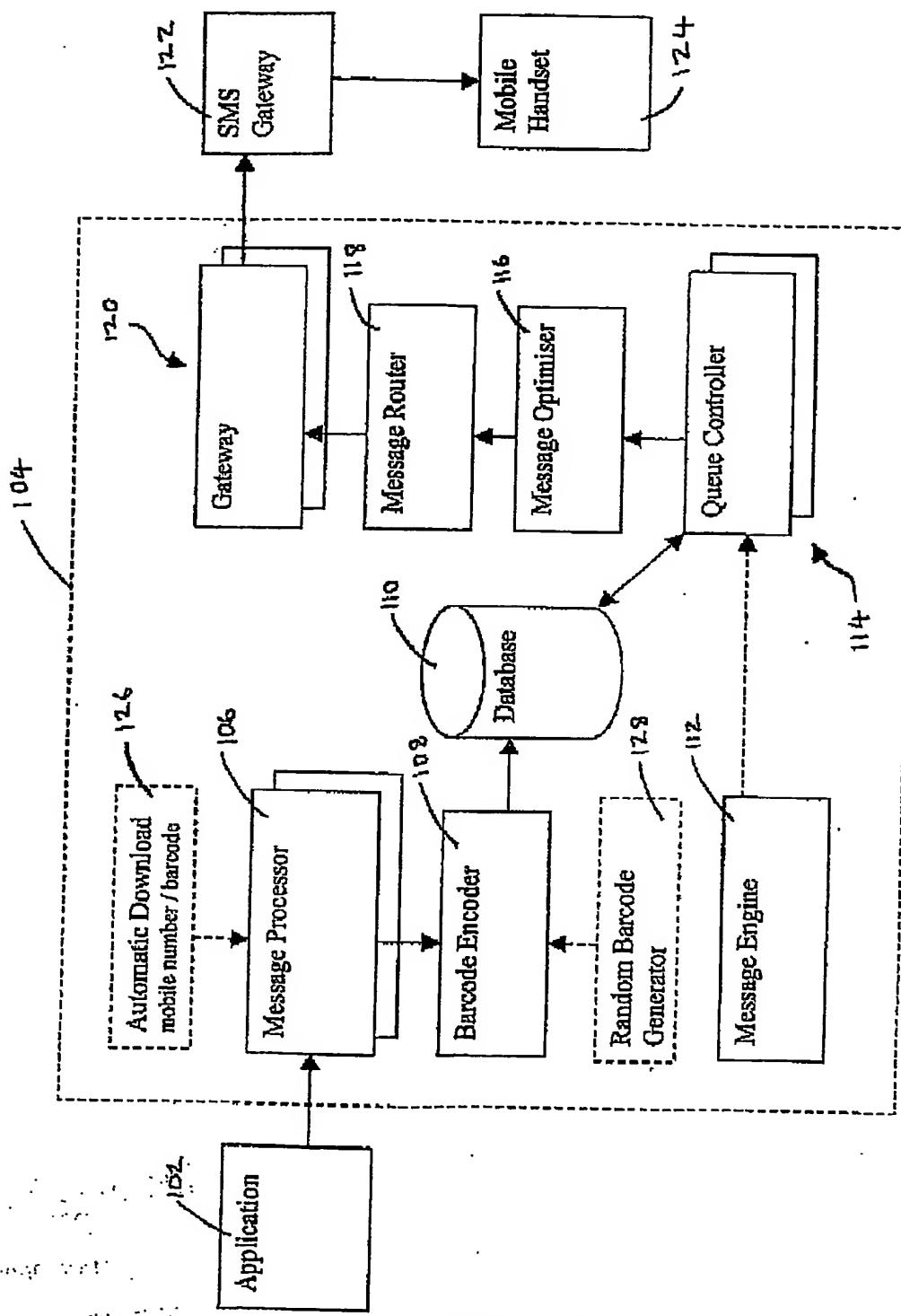
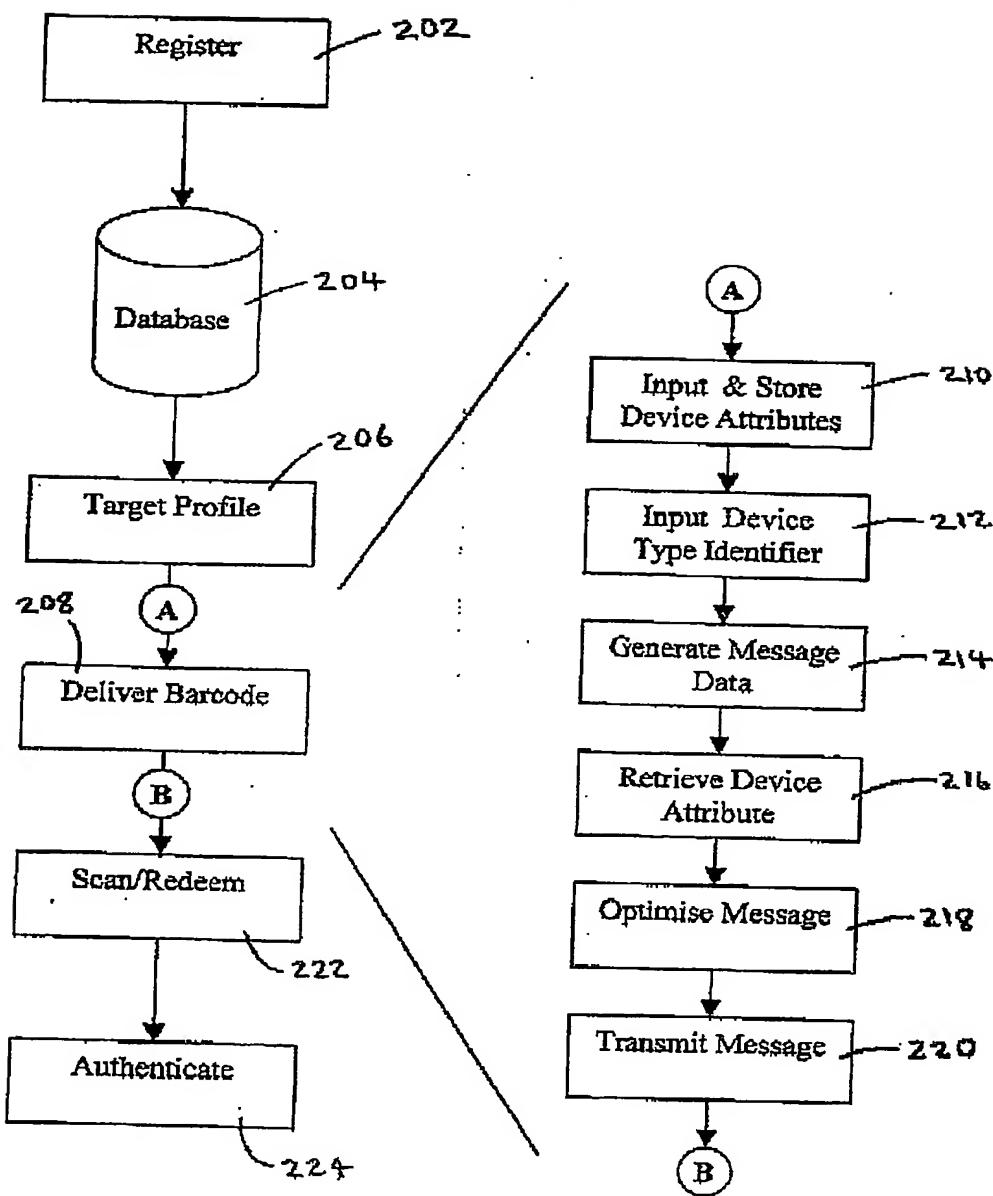
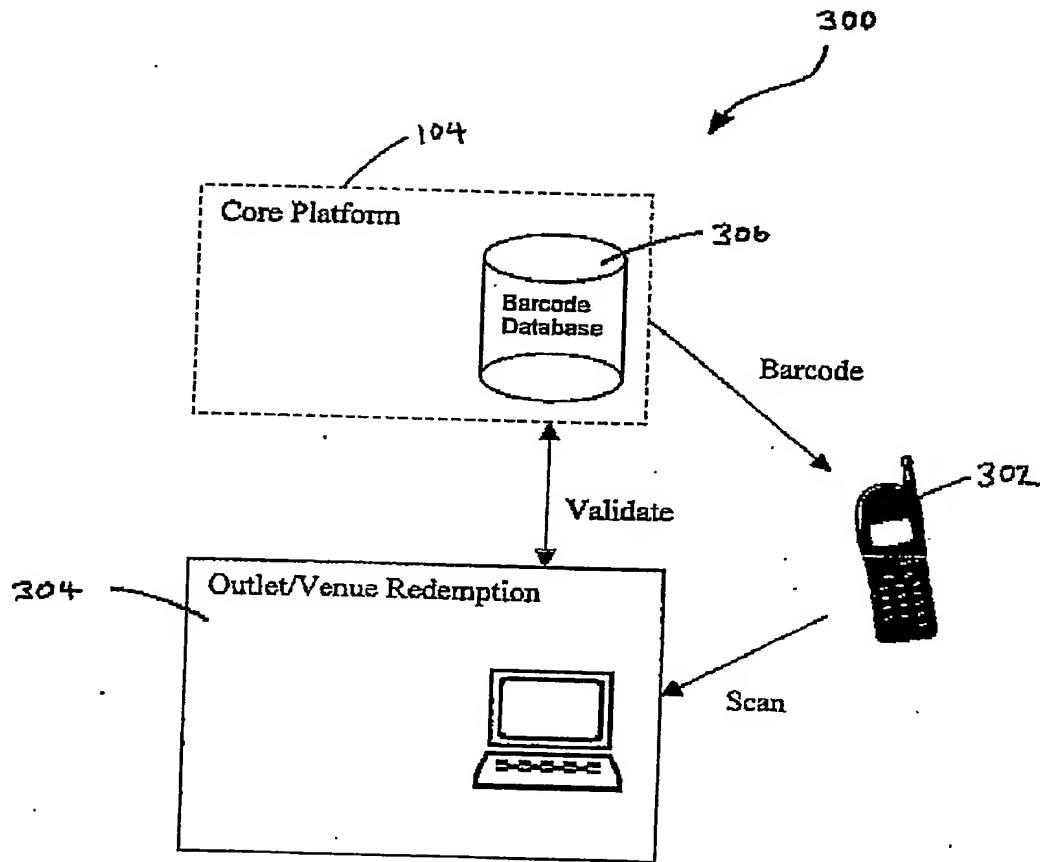


Fig. 1

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**Fig. 2**

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**Fig. 3**

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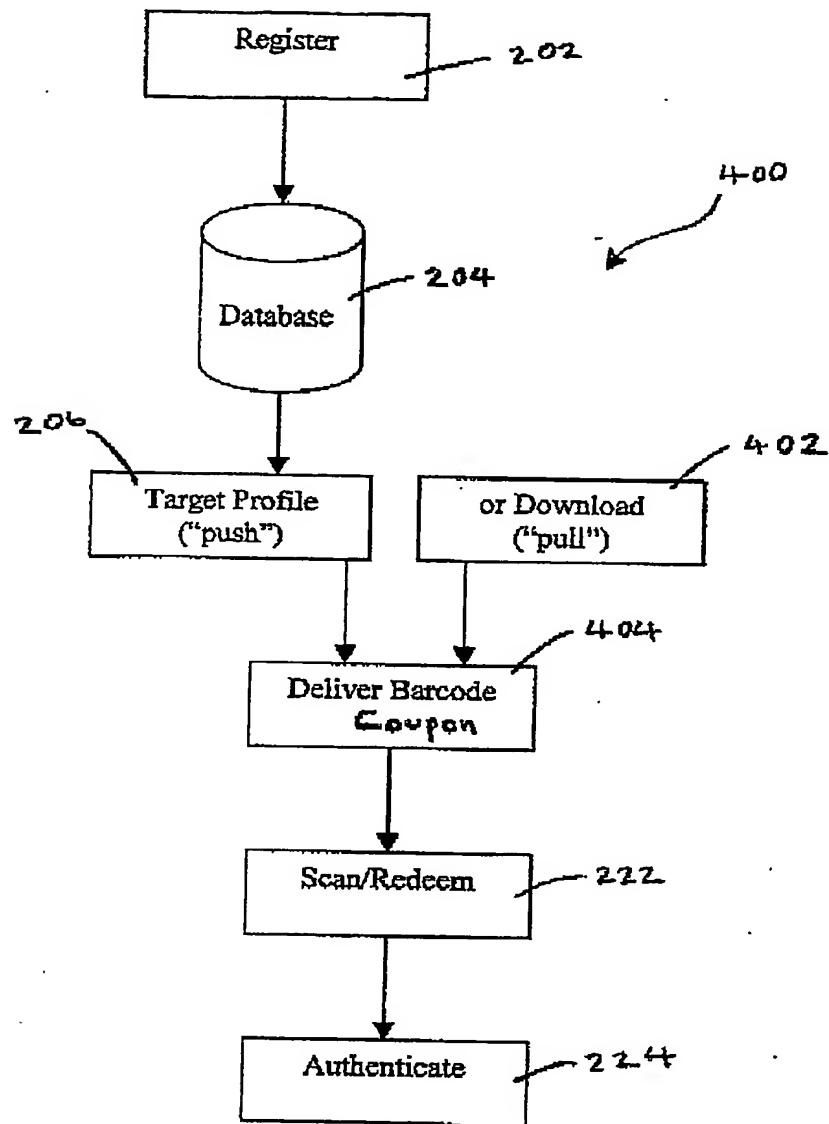
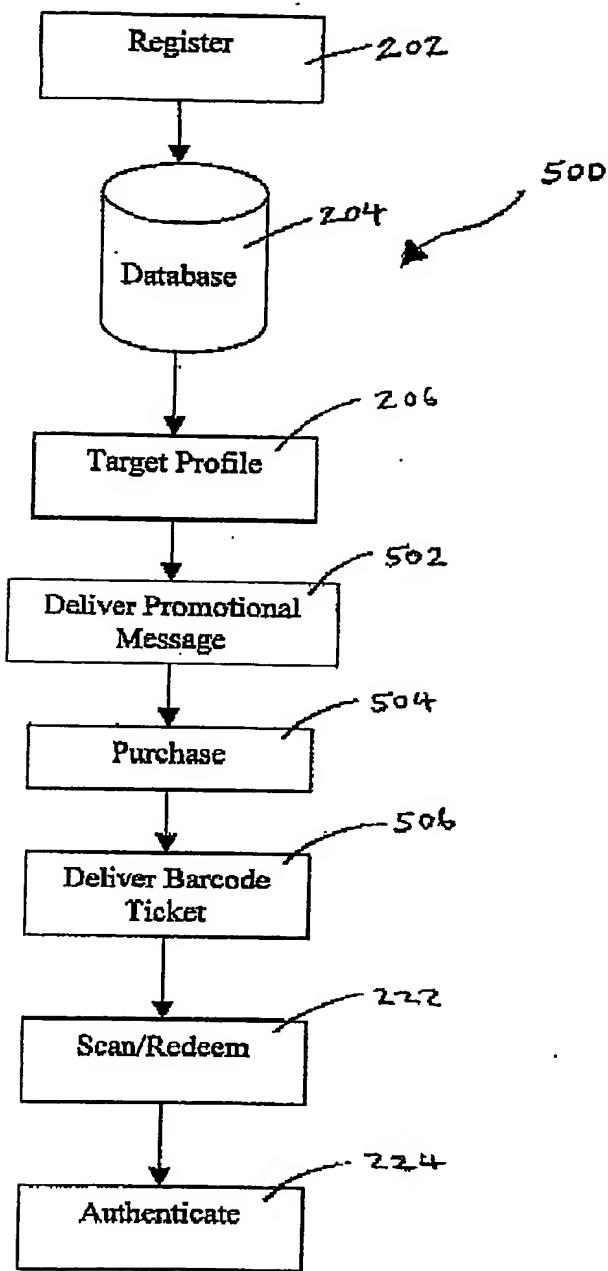
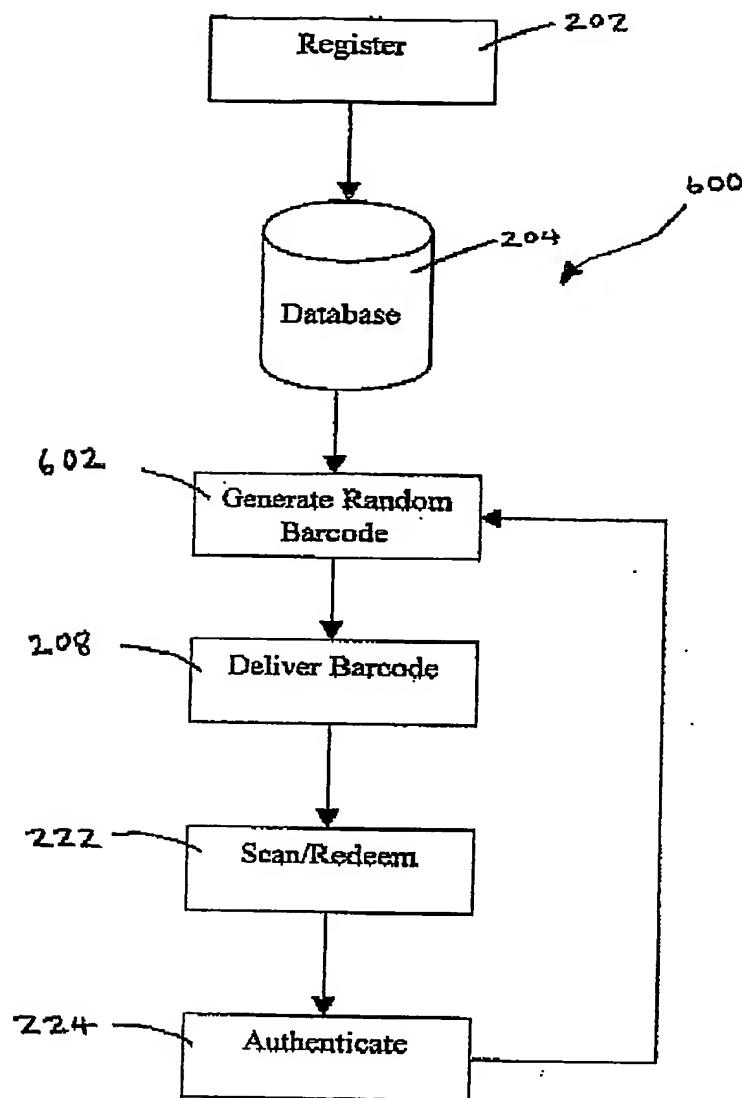


Fig. 4

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**Fig. 5**

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**Fig. 6**

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